REMARKS

Applicant respectfully requests reconsideration of the present application in view of the reasons that follow. Claims 1, 2, 4, 8, 11, 13, 14, 18, and 20-24 are now pending in this application.

Rejections under 35 U.S.C. § 103

Claims 1-5, 8, 11, 13, 14, 18, and 20 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,392,248 to Takahara *et al.* (hereafter "Takahara") in view of U.S. Patent No. 6,429,430 to Sato *et al.* (hereafter "Sato"), U.S. Patent No. 5,545,899 to Tran *et al.* (hereafter "Tran"), U.S. Patent No. 6,384,417 to Okumura *et al.* (hereafter "Okumura"), U.S. Patent No. 6,394,650 to Ohara *et al.* (hereafter "Ohara"), and U.S. Patent No. 5,640,016 to Matsuda *et al.* (hereafter "Matsuda"). This rejection is respectfully traversed.

Claim 1 recites a phosphor sheet for a radiation detector provided to be attached to a photoelectric conversion film of the radiation detector, comprising a support having a sheet shape; and a phosphor layer which emits light in response to rays of radiation transmitted through a specimen, and including a layer coated on said support with powder of a rare earth oxysulfide phosphor activated by europium of concentration in a range of 0.01 mol% to 3.5 mol%, wherein the rare earth oxysulfide phosphor powder has an average particle size in a range of 2 μm to 15 μm, wherein a filling factor of the phosphor powder in the phosphor layer is in a range of 60% to 80%, and the phosphor layer has a thickness in a range of 80 to 300 μm, and the rare earth oxysulfide phosphor has a composition expressed by: general formula: $(R_{1-a}Eu_a)_2O_2S$, wherein, in the general formula, R is at least one kind of element selected from Gd, Lu, Y and La, and a is a number which satisfies $1 \times 10^{-4} \leq a \leq 3.5 \times 10^{-2}$), wherein said phosphor layer has a surface that is configured to be bonded onto the photoelectric conversion film by an adhesive that transmits light, wherein the photoelectric conversion film includes an amorphous silicon film or a single crystal silicon film, wherein the surface has a surface roughness of 0.5 μm or less in average roughness Ra. Claims 2, 4, and 8 depend from claim 1.

Claim 11 recites a radiation detector, comprising a phosphor sheet configured to convert radiation rays transmitted through a specimen into light, wherein the phosphor sheet

comprises: a support having a sheet shape, and a phosphor layer including a layer coated on said support with powder of a rare earth oxysulfide phosphor activated by europium of concentration in a range of 0.01 mol% to 3.5 mol%, wherein the rare earth oxysulfide phosphor powder has an average particle size in a range of 2 μm to 15 μm, wherein a filling factor of the phosphor powder in the phosphor layer is in a range of 60% to 80%, and the phosphor layer has a thickness in a range of 80 to 300 μm, and the rare earth oxysulfide phosphor has a composition expressed by: general formula: $(R_{1-a}Eu_a)_2O_2S$, wherein, in the general formula, R is at least one kind of element selected from Gd, Lu, Y and La, and a is a number which satisfies $1 \times 10^{-4} \leq a \leq 3.5 \times 10^{-2}$), a photoelectric conversion film on which said phosphor sheet is layered, and which converts the light from said phosphor sheet into electric charges, wherein the photoelectric conversion film comprises an amorphous silicon film or a single crystal silicon film; and a charge information reading section having a plurality of pixels in contact with said photoelectric conversion film and reading out the electric charges generated on said photoelectric conversion film for each of the plurality of pixels as image signals of the radiation rays, wherein said phosphor layer has a surface bonded onto the photoelectric conversion film by an adhesive that transmits light, wherein the surface has a surface roughness of 0.5 μm or less in average roughness Ra. Claims 13, 14, 18, and 20 depend from claim 11.

Takahara discloses a color light emission sheet 4 that includes a flexible sheet base 6 and a phosphor layer 7 disposed on the sheet 6. See Takahara at col. 7, line 63, to col. 8, line 2. Sato discloses a scintillator panel 2 that includes a scintillator 12, a substrate 10, first transparent organic film 14, a transparent inorganic film 16, and a second transparent organic film 18. See Sato at col. 3, lines 9-32. Tran discloses a radiation detection panel 10 that includes a flat substrate 14, individual photosensitive modules 12, a phosphor layer 16, and a protective front plate 18. See Tran at col. 4, lines 58-67. Okumura discloses a ceramic scintillator that is produced by sintering particles and heat treating the sintered body. See Okumura at col. 2, lines 59-65; col. 3, lines 2-6; col. 4, lines 50-53; col. 7, lines 2-18. Matsuda discloses an x-ray detector that includes a scintillator 1 and a photodiode 2 that are optically connected by a transparent adhesive 3. See col. 2, line 66, to col. 3, line 3, of Matsuda.

However, as suggested by the Office on page 6 of the Office Action, Takahara, Tran, Sato, and Okumura do not disclose or suggest a phosphor sheet or a radiation detector comprising a phosphor sheet comprising, among other things, a phosphor layer having a thickness in a range of 80 to 300 μm, as recited in claims 1 and 11. Matsuda fails to remedy the deficiencies of Takahara, Tran, Sato, and Okumura.

The Office relies upon Ohara in an attempt to remedy the deficiencies of Takahara, Tran, Sato, Okumura, and Matsuda, arguing on page 6 of the Office Action that Ohara discloses a phospohor layer with a thickness of 50 to 400 μm, and more preferably 100 to 300 μm. See also Ohara at col. 11, lines 65-67. The Office apparently argues that the phosphor sheet or radiation detector comprising a phosphor sheet comprising, among other things, a phosphor layer with the thickness recited in claims 1 and 11 would be obvious over Takahara, Sato, Tran, Okumura, Ohara, and Matsuda due to overlapping ranges.

Even if one of ordinary skill in the art would have combined the teachings of Takahara, Sato, Tran, Okumura, Ohara, and Matsuda and the teachings of Takahara, Sato, Tran, Okumura, Ohara, and Matsuda can be considered to provide overlapping teachings with the phosphor sheet and radiation detector recited in claims 1 and 11, such a case of obviousness can be rebutted. See MPEP § 2144.05, Part III. The phosphor sheet and radiation detector of claims 1 and 11 provide an unexpectedly improved result due to the phosphor layer thickness recited in claims 1 and 11, as discussed in the disclosure of Applicant's application.

For example, as discussed in paragraph 0040 of Applicant's specification, if the thickness of the phosphor layer is less than 80 μm the amount of phosphor with respect to the thickness of the phosphor layer becomes relatively small, causing insufficient sensitivity in some cases, and if the thickness of the phosphor layer exceeds 300 μm, definition and sensitivity are generally lowered because the light transmittance of the phosphor layer is diminished.

Applicant submits that this demonstrates the accomplishment of an unpredictable and unexpected improved result that rebuts any general allegation that the invention would have been obvious due to overlapping ranges, particularly due to overlapping ranges of a phosphor layer thickness, as argued by the Office.

In addition, Applicant notes that Ohara does not disclose or suggest a rare earth oxysulfide phosphor having a composition expressed by $(R_{1-a}Eu_a)_2O_2S$, wherein, in a general formula, R is at least one kind of element selected from Gd, Lu, Y and La, and a is a number which satisfies $1 \times 10^{-4} \leq a \leq 3.5 \times 10^{-2}$), as recited in claims 1 and 11. Instead, Ohara discloses, among other phosphors, a terbium activated rare earth sulfide phosphor, a bivalent europium activated alkali earth metal phosphate phosphor, and a bivalent europium activated alkali earth metal fluorohalide phosphor. See Ohara at col. 9, lines 23-50. Thus, the teachings of Ohara regard different types of phosphors because Ohara does not disclose or suggest a rare earth oxysulfide phosphor having a composition expressed by $(R_{1-a}Eu_a)_2O_2S$, wherein, in a general formula, R is at least one kind of element selected from Gd, Lu, Y and La, and a is a number which satisfies $1 \times 10^{-4} \leq a \leq 3.5 \times 10^{-2}$), as recited in claims 1 and 11.

The deficiencies of Ohara are significant because one of ordinary skill in the art would not have applied the teachings of Ohara to those of Takahara, Sato, Tran, Okumura, and Matsuda because one of ordinary skill in the art would have understood that the teachings regarding one type of phosphor, such as thickness, do not necessarily apply to another type of phosphor. For example, when the composition of a phosphor is different than another, the particle shape and specific density of the phosphor powder are expected to be different, causing an optimum filling factor and optimum film thickness of a phosphor film to be naturally different. In another example, Ohara discloses a terbium activated rare earth sulfide phosphor with the properties shown in Table 1 of Ohara. When the concentration of an activator, such as terbium, is changed, the color and brightness emitted by a phosphor can be varied.

Based on this understanding that differences in the type of phosphor can vary the particle shape and specific density of a phosphor, and thus the thickness of a phosphor layer, and that differences in the type of phosphor can result in variation of the color and brightness emitted by the phosphor, one of ordinary skill in the art would not have applied the teachings of Ohara to those of Takahara, Sato, Tran, Okumura, and Matsuda to provide a phosphor layer having the thickness disclosed by Ohara.

Furthermore, one of ordinary skill in the art would have understood that combining the teachings of Takahara, Sato, Tran, Okumura, Ohara, and Matsuda would not provide a phosphor sheet or a radiation detector comprising a phosphor sheet comprising, among other

things, a phosphor layer having a thickness in a range of 80 to 300 μm, as recited in claims 1 and 11, because this combination does not provide a phosphor layer with a rare earth oxysulfide phosphor having a composition expressed by $(R_{1-a}Eu_a)_2O_2S$, wherein, in a general formula, R is at least one kind of element selected from Gd, Lu, Y and La, and a is a number which satisfies $1 \times 10^{-4} \leq a \leq 3.5 \times 10^{-2}$), as recited in claims 1 and 11.

For at least the reasons discussed above, reconsideration and withdrawal of this rejection is respectfully requested.

Claims 21-24 are rejected under 35 U.S.C. § 103(a) as being unpatentable Takahara, Sato, Tran, Okumura, Ohara, and Matsuda as applied to claims 1 and 11 above, and further in view of U.S. Patent No. 4,032,791 to Chiola *et al.* (hereafter "Chiola"). This rejection is respectfully traversed. Chiola fails to remedy the deficiencies of Takahara, Sato, Tran, Okumura, Ohara, and Matsuda as discussed above in regard to independent claims 1 and 11, from which claims 21-24 depend. Reconsideration and withdrawal of this rejection is respectfully requested.

CONCLUSION

Applicant submits that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing or a credit card payment form being unsigned, providing incorrect information resulting in a rejected credit card transaction, or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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